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DISEASES OF THE NERVOUS SYSTEM

A PRACTICAL JOURNAL ON PSYCHIATRY AND NEUROLOGY

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DISEASES of the NERVOUS SYSTEM

A PRACTICAL JOURNAL ON PSYCHIATRY AND NEUROLOGY

Carbon Dioxide Therapy of Psychoneuroses

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This paper reports a study of psychoneurotic patients treated with carbon dioxide-oxygen therapy. While numerous recoveries or improvements have occurred, there were too few cases studied to permit making any comprehensive statistical analysis. Therefore, we deal largely with case descriptions.

In 1929 Loevenhart, Lorenz, and Waters[1] reported that inhalation of a carbon dioxide-oxygen mixture by psychotic patients resulted in the restoration toward normal of their mental processes for a period of two to twenty-five minutes. They described one patient who had been mute for more than six years and who was able to converse successfully after carbon-dioxide therapy. Following publication of this article, carbon dioxide therapy was used widely on psychotics but with disappointing results and was ultimately abandoned. It was found that although a lucid interval occurred in some psychotics after treatment, the lucid interval became briefer as treatments were repeated and later failed to intervene at all with no recovery from the psychosis.

Meduna,[2] in 1946, while reinvestigating the work of Loevenhart, Lorenz, and Waters, was led by certain observations to hypothesize that psychotic disorders are disturbances of cortical functions, i.e., higher associative functions, while psychoneuroses may be conceived of as disturbances of lower structures of the brain which upset or distort the emotional values of concepts. Chemical or electrical agents which produce cortical discharges are beneficial in the psychoses but have little effect on the psychoneuroses. Epileptogenic agents producing motor but not cortical discharges seem to have no curative effect on psychotic conditions. He felt that if a method could be evolved which would affect mainly the lower structures of the brain, a profound alteration of the pathologic symptom in psychoneurotics might be achieved. Carbon dioxide gas was found to be a safe agent which did not produce cortical discharges but appeared to affect the lower structures of the brain.

In his studies of nerve physiology made on the isolated nerve, Lorente de No[3] found that carbon dioxide increases the membrane potential, raises the threshold of stimulation, increases the height and prolongs the duration of the action potential, and decreases the fatigability of the nerve. He also found that the nerve could be submitted to the effect of pure carbon dioxide for considerable periods of time without any resultant demonstrable damage to the nerve. He noted that the presence of carbon dioxide increases the ability of the nerve to perform work because the enzymatic mechanisms of the nerve utilize stores of metabolic energy more readily or more effectively in the presence than in the absence of certain concentrations of carbon dioxide. Also, carbon dioxide pro-

duces its effect independently of the external pH.

Meduna and Gyarfas,[4] in a study of the motor and sensory phenomena occurring in patients during carbon dioxide—oxygen therapy, explain the physiological phenomena on the basis of Lorente de No's work. The final resultant of carbon dioxide on the central nervous system is decreased cortical and increased medullary activity. They conclude: "It seems that our therapeutical administration of carbon dioxide produces decreased function of inhibitory cortical areas. The balance between inhibitory and facilitatory activity is clearly upset in favor of cortical and subcortical facilitatory functions. Why this is of benefit in any neurosis can only be answered when we have an adequate physiological theory of neuroses." Meduna[5] in another paper theorizes that the basic difference between a psychoneurotic and a normal person is to be sought for and found in a "disproportion between excitement and excitability." If this disproportion exists, the afflicted individual will develop a low threshold even to subnormal stimulation or an unduly strong reaction to normal stimulation. The suffering of this person must be greater than that of a normal person, and his endeavor to re-establish his homeostatic balance may be delayed, inhibited or prevented. Meduna goes on to say that if this conclusion be correct, then any procedure which is capable of increasing the threshold of stimulation of the brain must facilitate re-establishing the homeostatic balance and finally change behavior as the expression of the balance achieved by the procedure. As a means of increasing the threshold of stimulation of the brain against inside and outside stimuli, he evolved the carbon dioxide treatment for psychoneurotic conditions "which[3] eliminates the necessity of using symbolical approach to the psychoneurotic person." Meduna[6] explains his treatment as follows:

"This treatment consists of inducing anesthesia through repeated inhalations of carbon dioxide. The carbon dioxide increases the threshold of stimulation of every single nerve cell in direct proportion to the logarithm of the concentration of the carbon dioxide inside and outside the cell membrane. After a very few respirations of a mixture of 30 percent carbon dioxide and 70 percent oxygen, the increment in the threshold of stimulation is so great as to produce anesthesia. And, after the anesthesia has been terminated, its residuum is effective long enough to give to the whole brain adequate time to have an increased threshold for inside stimuli, time sufficiently long to permit the normal homeostatic balance of the brain to begin to function. By repeating the inhalations for a protracted period of time, the patient regains a normal homeostatic balance; and his excitability to old and new pathogenic influences becomes so lowered that the particular influences cease to be pathogenic."

In his preliminary paper on carbon dioxide—oxygen therapy, Meduna reported 20 of 32 psychoneurotics showed improvement and none of the six psychotics were improved. In his later report, 47 psychoneurotics were improved and 46 of the 93 were not improved. No psychotics were included in these last statistics. None of the 11 obsessive-compulsives were improved.

Kindwall[7] and his co-authors used 75 cases as a base for discussion on carbon dioxide therapy with 37 patients receiving no other specific treatment during their course of CO_2. Of these 37, eighteen were considered recovered or improved enough to go home, 11 were not noticeably changed, and eight seemed to have their symptoms aggravated. All 18 listed as recovered or improved were classified as psychoneurotic. Of the 11 apparently unaffected by the therapy, one was obsessive-compulsive, and two schizophrenic. Of the eight whose symptoms were aggravated, two were obsessive-compulsive and one was manic-depressive. Kindwall compares the individual carbon dioxide treatment to a brief, controllable toxic psychosis, during which there is reactivation and reintegration of pathological patterns into the dominant or conscious patterns. He suggests that this frequent reactivation and reintegration may be the therapeutic factor, a kind of desensitizing process.

Wilcox[8] uses carbon dioxide therapy to facilitate psychotherapy. He has the patient talk through every aspect of the carbon dioxide experience and then cautious added interpretations are given to the patient. He feels that psychotherapy is greatly shortened by this method and indicates that it shows promise in treatment of the psychoses.

Report of Cases

The carbon dioxide therapy was given by Meduna's method, using a mixture of 30 percent carbon dioxide and 70 percent oxygen. No intentional psychotherapy was given. All reality problems of in-patients were taken care of by another officer. Wherever possible, the patient was seen by the therapist only in the therapy room where conversation was limited to asking if a dream had occurred and requesting a description of it. Occasionally a few words of reassurance were given to an apprehensive patient during his first few treatments. Prior to acceptance for therapy, each patient was interviewed briefly. He was told that this was a new treatment and that it might or might not help him but that it would not harm him. He was further told that it was thought by some doctors that nervousness might be due to a low threshold for stimulation of the nervous system and that the carbon dioxide might raise that threshold to the point where his symptoms would improve. He was warned that the treatments would not be pleasant and would probably be frightening at first, especially the sensation of not being able to get enough air, but that sufficient oxygen was given with the carbon dioxide so that, in reality, he would be getting more oxygen than he would get normally. Following this brief interview, the patient's heart and lungs were examined and his blood pressure was taken. X-ray of chest was taken before therapy was begun. After 30 to 35 treatments, the patient was asked if he felt that he was getting any benefit from the treatment. If he replied that they were of no benefit the inhalations were terminated unless the patient requested that the treatment be continued.

Case No. 1—A 20 year old white male with history of severe throbbing frontal headaches beginning 10 months previously while at an overseas station. Headaches at first intermittent, soon became continuous. Was hospitalized twice at station hospitals prior to present hospitalization but was discharged each time when no organic basis could be found for the headaches. On admission to Fitzsimons General Hospital, a diagnosis of conversion reaction, chronic, severe, was made. He was placed on modified insulin therapy with concomitant psychotherapy for three weeks without improvement other than a moderate gain in weight. Hypnoanalysis was then carried out for a period of three weeks without any improvement. A great deal of material was obtained and accepted by patient intellectually but not emotionally. It was contemplated separating patient from the Service but as carbon dioxide therapy was being instituted at the hospital, it was decided to try him on this type of treatment. He was started on 20 inhalations of carbon dioxide—oxygen and this was increased rapidly to 70 inhalations and then gradually decreased to an average of about 40 inhalations as the technique of administering the gas was mastered. After ten treatments, patient stated that his headaches were much worse and he wanted to discontinue treatment. It was pointed out that the gas had not been given an adequate trial so he agreed to continue. The headaches gradually became milder with another excerbation after 24 treatments. Following this, there was a gradual improvement of symptoms until, following the 75th treatment, he had no more headache. Unfortunately, about 10 days after this, he was struck in the left eye with resulting laceration of the iris, intraocular hemorrhage, retinal detachment, traumatic cataract, and loss of all vision in the eye except for strong light. Following this injury, there was another exacerbation of symptoms, though much milder, and lasting about a month. A total of 109 treatments were given. Patient was returned to duty, He was later discharged from the Service because of the eye injury. About one month after returning to civilian life, and four months following completion of carbon dioxide therapy, the headache returned but not severe enough to interfere with his work. This patient denied any dreams throughout the course of treatment. He did exhibit an interesting motor phenomenon which began at about 20 inhalations and lasted until about 30 seconds after removal of the mask. This consisted of a simultaneous alternating change in the tonus of the contralateral upper and lower extremities, resembling quadrupedal locomotion. These motor movements were so marked that it was necessary to have patient remove his shoes prior to treatment to prevent tearing of the sheets on the table. Coma began at 23-28 inhalations and patient was conscious of but unable to control the movements of his extremities.

Case No. 2—A 20 year old white male with history of pain and aching in the calves of both legs of two years duration beginning within a few days after discharge from the Navy. He enlisted in the Army six months prior to hospitalization for the purpose of obtaining medical care for the pain in his legs. He was extremely well-developed physically with prominent musculature. After an exhaustive organic workup by the orthopedic and medical services, patient was given intensive psychotherapy supplemented with modified insulin therapy. Diagnosis was psychogenic musculoskeletal reaction, chronic, severe. There was no improvement after three months of psychotherapy so he was referred for carbon dioxide treatment. Patient was started on 30 inhalations of carbon dioxide—oxygen and

this was rapidly increased to 50 inhalations. Dreams, usually of traumatic nature occurred almost daily. Three types of repetitive dreams were noted. One, that of his only combat experience, was repeated several times during the first two weeks of treatment. Another, that of seeing a group of children playing in the street with a car speeding toward them, was repeated about once a week. The third repetitive dream involved snakes—either his falling in a nest of snakes (which actually occurred in childhood) or his seeing snakes in various locations. After thirty treatments, patient felt there was a slight improvement in symptoms so treatment was continued. The number of inhalations was increased at this point but without further improvement. After 47 treatments, coincident with his receiving word of a serious injury to his father in an accident, he began showing extreme fear during his treatments. He said that during coma he had very fearful dreams but could not remember the content. This fear left him tense and he began having difficulty sleeping at night. The number of inhalations was reduced to 25, and although patient had no coma or dreams, he was markedly tense during treatment and complained of tightness in all of his muscles. The number of inhalations was reduced further but patient complained of even more tenseness. It was decided to discontinue treatment temporarily and allow patient to go home for 30 days. On his return, he was anxious to resume treatment. However, after only 10 inhalations, patient was so tense, the treatment was stopped. Attempt was made to continue treatments but after only a few inhalations each time, patient doubled up complaining of severe cramps in muscles of abdomen and extremities. It was felt that further carbon dioxide therapy would be harmful so treatment was discontinued after a total of 89 had been completed. Patient stated that he was able to return to duty but denied any improvement in his symptoms.

Case No. 3—A 36 year old white female with history of hospitalization for one year for treatment of carcinoma of cervix in 1945. Nine months prior to present treatment she fell and began having pain in a small area just to the left of the 10th dorsal vertebra. Although there were no organic findings she was given deep x-ray therapy and novocaine injections to the area without relief. She was hospitalized for two months for complete study but no objective findings of significance were present. A diagnosis of passive aggressive reaction was made but psychotherapy was fruitless. Patient complained bitterly of this sharp pain in her back which was so severe as to prevent her from getting adequate sleep at night. Surgery on the 10th dorsal nerve was contemplated but it was decided to try carbon dioxide therapy first. Patient was started on 30 inhalations of carbon dioxide—oxygen and this was gradually increased. An optimum of 55 inhalations was reached after 57 treatments. Coma occurred after 23-28 inhalations. Following each of the first 18 treatments, she complained of nausea lasting two to three hours. After 22 treatments patient was able to sleep without being awakened by back pain although the pain was present during the day. The pain gradually subsided and was noticeable only after marked exercise or during an emotional upset. Termination was discussed from time to time but patient insisted that she was obtaining benefit from the treatments and wanted to continue them. After 175 treatments, therapy was discontinued. Patient insisted on returning several more times when the pain recurred but finally decided that the pain was no longer severe enough to warrant the long daily trips to the hospital. During the course of treatment, only one dream occurred. Patient dreamed vividly of being in a severe automobile accident. This occurred immediately after seeing a wrecked car while she was on her way to the hospital for treatment. On several occasions, it was noted that she had shown strong emotion during coma. She was asked what she had seen. Her reply was that she appeared to be walking on a road and could see the trees swaying as though by an approaching storm. During almost every coma, patient showed some emotion and frequently cried out as if in pain. Frequently she placed her hand over the area of pain on her back. Each time on awakening, she complained of an exacerbation of the pain during treatment and lasting for several minutes afterwards. If a treatment were missed, she complained of feeling tense and irritable until she received the next treatment. The sedative effect of the carbon dioxide has been noted by other patients. Follow-up one year after completion of treatment revealed that back pain was still present but of such low intensity that further treatment of any kind was not requested or desired.

Case No. 4—A 20 year old white male with history of daily and frequently twice-daily severe attacks of generalized urticaria for 5-months prior to commencement of carbon dioxide therapy. Having served a year at an isolated overseas post and been returned home, he was sent to a station halfway across the country from his home. Within one week, he began having severe generalized attacks of urticaria each night and frequently during the day. He was hospitalized three times at his station hospital for this urticaria and finally transferred to Fitzsimons General Hospital three weeks after onset. Here he was given a complete allergy work-up, including skin tests and a Rowe allergy diet. This failed to disclose any agent responsible for the urticaria. He was given both benadryl and theophrine but these failed to prevent an attack and only modified an attack after it had occurred. It was felt that the urticaria was of psychogenic origin so the patient was transferred to the Neuropsychiatric Service. Here he was given intensive psychotherapy for eleven weeks supplemented by a series of sodium amytal interviews. Patient showed no improvement and continued to have daily and frequently twice-daily attacks of severe urticaria, necessitating benadryl, and sometimes adrenalin to relieve the attacks. It was then decided to try him on carbon

dioxide therapy. After starting on 30 inhalations of carbon dioxide oxygen, this was gradually increased to the optimum dosage of 60-70 inhalations. After 30 treatments, patient still continued to have daily attacks of urticaria, although they were milder. He was told that since no real improvement had been noted, the treatments would be discontinued. He asked that the treatments to be continued because he felt more relaxed and was able to sleep much better. Treatment was continued then, and following the 45th treatment, he went one day without an attack. After this the attacks became milder and more infrequent. In February he had only one severe attack. In March, he had some mild attacks with only a few wheals on arms or legs which cleared up without medication. During the latter part of April, patient's grandmother, one of the two people to whom he felt an attachment, died. It was expected that he would have an exacerbation of his severe urticaria but he had only two moderate attacks. His enlistment expired at the time of his 85th treatment but patient requested that treatment be continued because he felt that he was improving. During the period of the last 40 treatments, only a few urticarial wheals occurred once or twice a week and these disappeared spontaneously in 15 to 30 minutes. During the entire course of therapy, no dreams occurred during coma. Quite frequently, coma did not occur in spite of the large number of inhalations. During the last half of the course of therapy, treatments were given twice daily 3-4 times a week. Patient had a total of 203 treatments, was discharged to duty and returned to civilian life. Follow-up one year after his last treatment revealed that urticarial attacks continued to gradually decrease in intensity and frequency. There have been no attacks at all during the past five months.

Case No. 5—A 27 year old white male who had been hospitalized 5 months before carbon dioxide therapy was begun. Patient was hospitalized because of an hysterical paralysis. This cleared up in about two weeks but was replaced by symptoms of a severe anxiety neurosis. Since he was number one in his OCS class, he was retained at the station hospital for six weeks to rehabilitate him for return to school. No improvement occurred so he was transferred to Fitzsimmons General Hospital. For ten weeks he was given psychotherapy and a course of modified insulin therapy with only slight improvement. Since it was believed that marital difficulties were the basis of his anxiety, he was given a 30 day furlough to straighten these out. He was unable to clear up his domestic difficulties and on his return to the hospital, his anxiety symptoms were worse. It was then decided to start him on carbon dioxide therapy. The following is his own account of carbon dioxide treatment, which closely paralleled objective observations:

"The first week of treatment was very hard to take as it seemed to frighten me considerably and the result of being afraid was that I fought more and more against treatment. The second week of carbon dioxide made me extremely nervous, even more than before, and it also caused me to have a strong feeling of forgetting something constantly, but during the third and the following weeks, I could notice that I could relax better and think more clearly. I lost that feeling of forgetting something all the time. Before I started taking the carbon dioxide I couldn't sit through a movie or read through a newspaper without getting very nervous and restless, and would have to leave what I was doing and take a walk or do something to combat my restlessness but as the treatment continued, I could do most anything with ease, without getting nervous at all. After I had taken about 40 treatments, I started to have the same reactions as I had when I first started; this lasted about five days and then the reactions became normal and relaxing again. At the present time I have taken about 90 treatments and I feel like a new man. Things I couldn't do before I can do now with all the ease in the world."

Patient was started on 30 inhalations of CO_2 and this was gradually increased. When 40 inhalations were reached, respiration ceased but was resumed as soon as the mask was removed without any convulsion or motor phenomena occurring. After this happened several times, the number of inhalations was reduced. After two weeks, inhalations were gradually increased until during the latter third of therapy, they averaged 60-70 without any further episode of apnoea. No dreams occurred or were remembered during the entire course of therapy. Patient was returned to duty after 60 treatments and took the remainder of the total 109 treatments on an out-patient basis. An essential head tremor had been present since recovery from cerebral malaria, in 1942. This was the last symptom to disappear during carbon dioxide therapy. However, during each period of coma, the head tremor became marked but would disappear a few minutes later. One month after termination of treatment, the essential head tremor reappeared. Four months after completion of treatment, after another fruitless trip home to straighten out his domestic duties, patient had a short hysterical episode followed by mild anxiety symptoms. He returned for several carbon dioxide treatments. He voluntarily terminated treatment as he felt that he had recovered. Follow-up one year after completion of treatment revealed presence of the essential head tremor but no evidence of anxiety symptoms. He has continued to perform his duty assignments in a superior manner.

Case No. 6—A 26-year old white male, diagnosis of severe chronic anxiety neurosis manifested by recurrent battle dreams, tremor, left facial tic, nausea, vomiting, abdominal pain, anorexia and insomnia. He had received psychotherapy and a course of modified insulin therapy at an overseas hospital for a period of six weeks but his symptoms became worse so he was transferred to Fitzsimons General Hospital. After a furlough home to clear up some realty problems, patient was placed on carbon di-

oxide oxygen therapy. He was started on 30 inhalations of the gas and this was gradually increased to an average of 60-70 inhalations. After 20 treatments, his symptoms began clearing up. Between the 36th and 40th treatments there was an exacerbation of symptoms accompanied by a moderate depression, during which he contemplated suicide several times. Symptoms again improved but with another exacerbation for several days following the 55th treatment. After this, his symptoms gradually cleared up and he was discharged after having received 81 treatments. This patient made the observation that he felt very relaxed for a period of about 6-8 hours after each treatment. He suggested that if treatment were given in the afternoon, he would be less tense at night and would be able to go to sleep more readily. This was done and at a later date treatment was given twice daily in order to prolong the period of relief from tension. During the first half of the course of treatment, several times a week, patient showed moderate to marked emotion during coma. This was accompanied by combat dreams. These abreactions became fewer as patient's symptoms improved and his battle dreams at night gradually disappeared. Follow-up eight months after completion of treatment revealed that patient's anxiety symptoms reoccurred several weeks after discharge from hospital but were less intense, episodic in nature, and lasted approximately 48 hours. Apparently gastrointestinal symptoms have not recurred.

Case No. 7—A 40 year old white male with history of two hospitalizations for conversion reaction and chronic anxiety reaction. Two weeks after discharge from last hospitalization, he was referred for carbon dioxide therapy because of almost daily mild attacks of acute anxiety, severe startle reaction, and nocturnal enuresis which had recurred following prolonged combat from 1943 to 1945. Patient was a ward attendant on the NP Service and was carried on an outpatient basis. He was begun at 30 inhalations of carbon dioxide oxygen and this was gradually increased to an average of 65 inhalations per treatment. During the first 27 treatments, enuresis occurred during treatment almost daily. It then became less frequent and stopped after the 33rd treatment. During this same period of time the nocturnal enuresis disappeared. After 17 treatments, patient began having a feeling of exaltation and relaxation during the treatment. The relaxation carried over for a period of 24 hours during the first half of the series, and patient made a point of not going more than 48 hours without a treatment because if he did, he would gradually become tense again. All of his symptoms cleared up by the 75th treatment but they were continued to a total of 120 at his request. This patient was the only one to really enjoy his treatments. He almost invariably had a dream during which he was relaxing out in the sun after a hard day's work and had a premonition that something was about to happen. He frequently expressed regret that he had not been given a larger dose of gas so that he would know the result of his premonition. Follow-up three months after completion of treatment revealed no recurrence of symptoms.

Case No. 8—A 26 year old white male with history of having been a Japanese prisoner of war for three and a half years. He had been given only supportive treatment prior to discharge from the service. In civilian life he had been unable to hold a job because of his anxiety symptoms. He was given psychotherapy at a mental hygiene clinic for two years, enabling him to complete training and obtain a job. During treatment his symptoms gradually became worse. He had "blackout" spells, became confused easily, would make mistakes and forget things at work. He was more irritable at home, had difficulty in concentrating, insomnia, and nightmares of prison camp trauma. Finally, he became so irritable at work that he gave up his job and requested hospitalization. Psychotherapy was begun but because of the marked hostility and resistance, it was felt that the patient was a poor treatment case and he was referred for carbon dioxide therapy. After starting patient on 25 inhalations and gradually increasing the dosage, it was lowered to about 12 inhalations because of the marked abreactions of traumatic prison incidents and combat. With only 12 inhalations, coma began as early as the fourth inhalation. Such marked emotion occurred during these abreactions that patient frequently had to be held on the table to keep him from injuring himself. The number of inhalations was gradually increased as improvement occurred and length of coma decreased. Twenty inhalations was reached after 52 treatments, 40 inhalations after 119 treatments, and 50 after 148 treatments. First improvement was noted after 20 treatments when patient became more relaxed and began sleeping better. By 70 treatments most of the symptoms had cleared up, although he had an occasional combat dream. After 30 treatments, tremor and hyperhidrosis had cleared up. After 145 treatments, no further abreactions occurred. Patient appeared so well by 150 treatments that termination was discussed. He insisted on having 210 treatments, saying that this was the first time he had felt well since the war and wanted additional treatments to make sure that he would maintain his improvement. Follow-up six months after completion of treatment reveals that patient has maintained most of his improvement. He now has occasional nightmares and episodes of irritability but is able to work full time without any trouble. This patient, after 35 treatments said that he felt relaxed for 6-8 hours following each treatment and asked that he be given afternoon treatment to carry over the relaxation to bedtime. Treatments were then given to him twice daily, 4 times a week, for the remainder of the course.

Case No. 9—A 44 year old white male with diagnosis of chronic alcoholism, severe. History of heavy drinking for 18 years. Was admitted to the hospital after a six months drinking spree and was bordering on a state of delirium tremens. After

routine withdrawal treatment, patient was placed on modified insulin therapy for three weeks and then sent to the open ward for carbon dioxide therapy. No psychotherapy had been given. He was started on 25 inhalations of carbon dioxide oxygen and this was gradually increased. It was found that dosages as large as 90 inhalations of the gas were necessary to produce coma. Gradual improvement took place with loss of tremor noted after 30 treatments. Judgment and insight gradually returned to normal. He received a total of 68 treatments. Follow-up seven months after end of treatment revealed that patient has maintained his improvement, has made an excellent social adjustment, and has not resorted to alcohol.

Case No. 10—A 26 year old white male with history of onset of stuttering 4 years previously when a buzz-bomb struck near him in Belgium. Patient was given carbon dioxide therapy on an out-patient basis but received only 16 treatments before being unexpectedly transferred away from the hospital. At time of transfer, his immediate supervisor noted a marked improvement in his speech. Patient was contacted five months later but did not attribute his improvement in speech to carbon dioxide, saying that he had had such remissions previously. However, he said that he had been more relaxed and less nervous since taking the treatments. Stuttering at this time was still improved. Optimum number of inhalations was found to be 35-45. During the course of treatment, patient had only one dream, an abreaction of a fight in childhood, the only fight he had ever had.

Case No. 11—A 21 year old white male. Diagnosis of passive aggressive reaction, chronic, severe, with elements of psychopathy. Admitted to hospital because of frequent episodes of acute alcoholism and because of moderate anxiety symptoms. Patient showed marked apprehension at each treatment. Number of inhalations averaged only 18 because of marked tension during treatment and coma was rarely attained. When coma did ensue, dreams were of unpleasant episodes of his past or else a recurring dream of many eyes staring at him. Treatments were given twice daily. Therapy was terminated after 60 treatments because of patient's frequent infractions of hospital regulations and because it was felt that his constant alcoholic episodes were negating the treatment. No improvement was noted other than a slight decrease in objective signs of anxiety.

Case No. 12—A 26 year old white male admitted to the hospital because of frequent episodes of alcoholism. Diagnosis was schizoid personality. Psychotherapy, including an attempt at hypnoanalysis over a period of six months was fruitless so patient was referred for carbon dioxide therapy. He was started on 20 inhalations of the gas and it was increased to 60 inhalations with only one coma occurring. Constant use of alcohol by the patient interfered with treatment. Finally, after absence from treatment for a period of a week, because of acute alcoholism, therapy was discontinued without any improvement having been noted. A total of 27 treatments was given.

Case No. 13—A 36 year old white male with history of stuttering since early childhood. Patient was started on 20 inhalations of carbon dioxide oxygen which was gradually increased to 40 inhalations. Coma occurred during each treatment but dreams were denied. Therapy was terminated after 17 treatments when patient could no longer remain in the hospital because of pressing financial matters at home. No improvement was noted.

Summary

1. Thirteen psychoneurotics were treated with carbon dioxide by Meduna's method.

2. Some of these patients had previously been subjected to other types of therapy with little or no improvement. The improvement noted in many of them following carbon dioxide treatment would indicate that this method of therapy should be investigated further.

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Families of Manic Depressives

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This study has been confined to those persons, or the families of those persons who develop manic depressive psychosis. The diagnosis of manic depressive psychosis was based on the occurrence of acute, self-limited attacks of depression, alternating with similar periods of over-activity, also self-limited. There needs to be a periodicity to the attacks, but neither the mania nor the depression need always be outstanding, although one form of affective response must necessarily be of psychotic proportions to make the diagnosis possible. Cases of neurotic depression, involutional melancholia and other forms of depressive response were not included. However, the case that had superimposed schizophrenic features or marked paranoid trends was not excluded since the fundamental manic depressive reaction was present for study. It is not held by the writer that this is the only type of personality having intercurrent attacks of depression and elation, but we feel that this is the definite type found most frequently in those people who develop this disease before the fifth decade of life and show no personality disintegration before or following these psychotic episodes.

When the personality study is confined to this group a definite type of individual is discovered. From the psychiatrist's point of view he is uninteresting because he is hard to get at. He is friendly and superficially cooperative, but soon personality investigation ceases because the patient refuses to be self-analytical. When the patient is depressed or manic his illness seems to explain his unapproachableness, and when he is well he will have nothing to do with you except in a very superficial way. This impenetrable shell is characteristic of persons with this illness and sets them apart from those having other forms of depression, so that one might hypothecate that this form of depression could not be closely related to the other types.

This characteristic of the manic depressive personality has long been known. Freud[2] emphasized the narcissism of these individuals and the narcissistic nature of their libidinous attachments.

Dr. Spurgeon English[3] made these pertinent observations on trends in manic depressive psychosis:

"The manic depressive personality presents a mild and passive manner and is not openly argumentative but is, nevertheless, stubbornly resistant to new ideas and new feelings. Due to anxiety the manic depressive has a great rigidity of imagination—in a sort of single track mind. He knows only one way to solve a problem, one pattern of relating himself to people. He likes something 'because he likes it' and sees no reason to amplify his statement. If he dislikes something he dislikes it and he cannot break down this dislike into any component parts... The manic depressive is afraid of extremes of emotion, of great love, of hostility, and yet these are the very things he may show in his illness."

Frieda Fromm-Reichmann[4] in a discussion of Dr. English's paper reporting from her biographical childhood data about manic depressive states:

"From the childhood history of our patients they come, as a rule, from families with multiple parent figures, who share the responsibility for the guidance of the infant and child. There is no single, significant adult who carries full responsibility for the child and to whom he can relate himself meaningfully. Moreover, there is usually no one who is interested in the welfare of the child in his own right. The relatedness of the grown-ups to the child is determined by the purpose for which it is needed, and by the role into which it is cast according to the needs of the family."

These needs are usually determined by the fact that these families belong to isolated, privileged or underprivileged minority groups to whom it seems necessary to maintain certain standards or to fight for survival. They accomplish these necessities by eagerly cultivating their part in a closely knit group unity and by adhering and teaching their young to adhere to their conventionalized group values.

Manic depressives can only be treated successfully if the therapist is able to help them break through their clinging dependence upon the family and its substitutes, and to re-evaluate the conventional group values of the family.

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Dr. Fromm-Reichmann indicates in this same discussion that persons who develop this mental illness have committed some breach of family etiquette which makes them feel unworthy of the family and, to a certain extent, excluded from the group.

In our experience true manic depressives act in the manner described by Dr. English. Often these people would answer our inquiries with—"I was not raised to do that," or —"I was not taught to think that way." So we were led to believe, like Dr. Fromm-Reichmann, that family pressure had a great deal to do with the personality of manic depressives, and probably with the formation of the disease.

In 1934 an investigation of the family backgrounds of manic depressive and dementia praecox patients was carried out by students of the Smith College School for Social Work.[5] Their conclusions regarding families in which manic depressive psychosis occurred are summarized in the following statement:

"In a large proportion of the homes handicapping emotional conditions of one type or another were reported. The home conditions seemed somewhat worse, on the average, in the manic depressive group while among the schizophrenics, individuals of poor social adjustment were more frequent. . . . Over protection, often of an extreme form was fairly common, especially in the manic depressive group, and in a third of the cases the mother was unusually dominant and the father played a very weak role."

Over a year ago we began a study of manic depressive psychosis with the idea of approaching the individual case from the point of view of the family. The object was to learn what sorts of families had members who showed the manic depressive reaction. It was felt that if our idea of the type of personality which had the disease was correct, that regardless of the influence of heredity, there must be powerful factors in the environment shaping the individual. The preliminary findings of our study were published in this Journal.[6] In this report we showed that the disease occurs at least one third more frequently in the southern states than anywhere else in the United States except Maine and Wisconsin. In the state of Virginia 39% of first admissions to state hospitals were diagnosed as having manic depressive psychosis. In this region family life was shown to be more static, especially the life of the middle classes.

In order to check our opinion of the importance of family pressure an opinionaire originated by the Fels Research Institute to study child-parent relationships was modified so that the dominance by parental pressure could be evaluated. Twenty-three traits were considered. Answers were obtained from members of families containing patients with manic depressive psychosis and these were compared with opinionaires from members of families which demonstrated no such reaction. These comparisons showed a significant difference. Families containing members who had this disease exhibited a greater increase in parental pressure toward family conformity and a decrease in independence of individual members. This finding was sufficiently definite to make us feel it was worthwhile to study such families more intensively.

Since that time twelve families have been selected for close study. They are families living in Virginia, West Virginia, Maryland and North Carolina. One or more of their members have been patients at the University Hospital. At least three generations have been known to the writer and, in some cases, five generations have been studied. Several members of each of these family groups are available for study. These families were considered in regard to the permanence of their cultural pattern. Had they moved, and if they moved did they maintain or change their social setting? Next, was the unity of the family maintained? Frequently families may scatter as far as position is concerned and yet he held close together by some dominant figure or tradition. Third, how strong does the family tradition seem to be and how much intra-familial pressure to conform is there? Is there any relationship between dependence and conformity and the occurrence of the manic depressive reaction?

This information was obtained through the use of the Modified Fels Opinionnaire and by means of frequent interviews with as many members of the family as it was possible to reach. It was soon found that the family had to be approached from several points of view before any conclusions could

be reached. The feeling of the sick members was often very different from that of the others, especially in regard to more or less repressed hostility.

Family One is composed of a father and mother and four sons. Three of these sons had manic depressive psychosis. John Q., the father's father, was a Baptist minister. He had six children. These children married and had families which would be classified by Jurgen Reusch[7] as upper middle class. There were no major personality disorders in the family of John Q. Fred, the father of the family in which we are interested, married Ada P. who had ten siblings. One of these ten siblings became psychotic after she had reached middle age. Ada was very domineering and socially minded and put a great deal of pressure on her boys to excel. Her husband, Fred, escaped the pressure by entering into the social life of the town. The three older boys attempted to conform to the mother's demands, so that the three sons and the mother lived in a very close unit in which there was great pressure for intellectual and social success. The three boys made brilliant records and then succumbed to manic depressive psychosis. One is now dead. The other two still suffer from the disease. The fourth boy revolted against the family pattern and was partially rejected by the rest of the group. He finally became an alcoholic and died of heart disease. Fred had a younger brother, Charles, who married a younger sister of Ada P. There were six children who were handled with stern discipline but no dominance. There was a great deal of independence in this family. The children were allowed to follow their own bent. The family unity was not too great. The children have scattered throughout the country and there is no mental disease. It would seem that in this case, when two brothers married two sisters, there should have been some disturbance in Charles' family if heredity were the only determinant for the appearance of the disease. In this family no evidence of the traumatic situation which Frieda Fromm-Reichmann described could be found. In summary, this family has been static for several generations. It formed a very close unit. The family tradition is strong and the family pressure to conform was very high. Three members conformed and succumbed. The other member revolted, escaped, but became an alcoholic, and died of vascular disease.

FAMILY ONE

1. Location	Same
2. Social status	No change in culture
3. Unity	Very strong
4. Tradition	Strong
5. Dominance	Mother dominant
6. Motives	Social and intellectual
7. Evidence of hostility	Strong
8. Conformity of well members	One did not conform, alcoholic

Large family. Three manic depressives.

Family Two is composed of members who are descended from people who founded this nation. The last two generations have furnished missionaries to China. Those remaining at home have lived in Virginia, so the family has been held close together by a firm family tradition. The father of the family, C., had seven siblings—one sister has a definite manic depressive make-up. He married Mary S. who had two half sibs. There was no mental disease on her side of the family. C. and M. had seven children. Two of these have definite manic depressive psychosis. The tradition of this family was set years ago. The attitude was Victorian toward sex but more liberal in other lines. The dominant themes were honesty and religion. The family was self-sufficient and tended to live to itself and there was strong pressure to conform. In this case, Martha, the oldest, went into revolt, tried to be eccentric, but developed manic depressive psychosis; while M.C., the youngest, felt rejected and somewhat out of step, could not conform, especially from a sexual angle, and developed manic depressive psychosis. The dominant mother forced conformity on this

FAMILY TWO

1. Location	Moved. Here and China
2. Social status	Culture pressures same
3. Unity	Very strong
4. Tradition	Very strong
5. Dominance	Mother dominant
6. Motives	Religious, intellectual, social
7. Evidence of hostilit	Not obvious except in one
8. Conformity of well manic members	All except two sick members

Large family. Two manic depressives.

family. The two daughters who attempted to revolt did not move away but remained on the fringe and definitely dependent. They showed a great deal of hostility to the family pattern while the other members conformed and thrived on it.

Family Three: Two brothers married two sisters. One brother was a general practitioner, the other a business man. Both were successful. The doctor had five siblings and his wife had ten. There is no history of manic depressive disease for several generations preceding the marriage. Dr. H. and his wife had nine children. B. was the oldest, then Dick, G., four girls and then Nathaniel and finally Kitty. Mrs. H. not only had children but raised them. She has been, and still is, the dominant leader of this group. Finances were tight in the beginning but the main motive has been social success and recognition. The family has moved, but always in the same culture, and although scattered slightly, is still held as a unit. One member, Dick, has revolted and moved away. Kitty was somewhat rejected but has thrived upon it, since she escaped the family pressure. One of the four girls and Nathaniel had elations followed by depressions, and both took their own lives.

B., the oldest boy, married into a family dominated by a real patriarch. The theme here was economic success and there was very little warmth or love among the members. Yet the family was held as a tight unit. B.'s wife, and one of her sisters, showed both elation and depression. Their two children suffered from manic depressive psychosis, although one was pure manic depressive, while the other showed schizophrenic tendencies.

These grandchildren of Dr. H. and his wife, B.'s daughters, did not escape the family pressure. They were, rather, engulfed by the *two* family pressures, which were somewhat hostile. The illness of their mother made it almost impossible for them to form any sort of identification except with one of these two opposing cultures, which joined together to force them into a mixed conformity. They were dominated by the family and dependent upon its needs.

FAMILY THREE

1. Location	Travelled
2. Social status	No change in culture
3. Unity	Very strong
4. Tradition	Very strong
5. Dominance	Mixed
6. Motives	Social and power
7. Evidence of hostility	Sick members hostile
8. Conformity of well members	All conformed. Alcohol in quantities.

Large family. Four manic depressives.

Family Four: Among the foothills of the Blue Ridge mountains the family of F. settled many years ago. There the family built a flour mill and a store. Grandfather, Albert G., built the big house and his sons built up and down the small river that turned the mill wheel. Through the years the family has lived a closed-in life in this beautiful but narrow valley. The family unity has been maintained. The father was apparently dominant but the mother ruled from the sick bed. No one dared to cross her because of her nerves. Political power and wealth were the driving motives of this family. The families are still held close but there is much evidence of hostility now that the patriarchal grandfather is gone. He lived to be over ninety.

The oldest son, J. had manic depressive psychosis. The third son, G. had recurrent depressions. J. had five children and two out of the five developed manic depressive psychosis. There is something of an old world dominance here that still reverberates through this valley. One of J's sons revolted, moved away, but is now moving back. It is hoped that he will escape the usual fate that accompanies such a return.

FAMILY FOUR

1. Location	Never moved
2. Social status	No change in culture
3. Unity	Very strong
4. Tradition	Very strong
5. Dominance	Mixed
6. Motives	Money and social power
7. Evidence of hostility	Sick members hostile
8. Conformity of well members	All except members who were sick conformed.

Large family. Four manic depressives.

Family Five: The patient in this family is directly descended from a former president of the United States. He lives in the house that the president lived in during his latter days. He has attempted to identify with the family picture of his great fore-

bearer, but he is also under the immediate influence of his father, who as a local judge, acted as a father surrogate to the whole countryside. He has two sisters and one brother. The two sisters have moved away but conform to the culture while the brother remains, in revolt against the family pressure. The brother has not broken down but is alcoholic. The patient, who has had definite manic depressive psychosis, is held firmly by tradition and dominated by no definite individual as much as by the culture pattern of his family.

FAMILY FIVE

1. Location	Same
2. Social status	No change in culture
3. Unity	Unity, except one brother
4. Tradition	Strong
5. Dominance	Mixed
6. Motives	Social Power
7. Evidence of hostility	A great deal
8. Conformity of well members	They do not conform. — Brother alcoholic

Medium family. One manic depressive.

Family Six: In a small city in Virginia Family Six has lived for several generations. These people live the good life in a very narrow fashion. Their wants are few which they are able to gratify. If they have a motto it is that of self-restraint on all occasions. The father seems dominant, but it is the mother who has ruled by her neurotic complaints. One son revolted but has not moved away. He is now an alcoholic. There are two persons with manic depressive psychosis in this family.

FAMILY SIX

1. Location	Same
2. Social status	No change in culture
3. Unity	Very strong
4. Tradition	Very strong
5. Dominance	Mother dominant
6. Motives	Religious and security
7. Evidence of hostility	Definite evidence of de-
8. Conformity of well members	pressed hostility All except one. Alcoholic

Large family. Two manic depressives.

Family Seven starts in England. One son ran away from home and shipped to New Orleans. There he joined the Confederate Army. After the war he married and settled down in Virginia. His wife's people were very intelligent. Their son became a merchant but was more interested in books than in his business. He married a very aggressive woman of superior qualities. There were three children. The two older children were held as a close unit by the dominant mother. The theme of this family is success along literary lines. One son developed manic depressive psychosis. The other son revolted, left home and escaped the family pressure. He died of coronary disease. The son who developed manic depressive psychosis also has coronary disease.

FAMILY SEVEN

1. Location	Same
2. Social status	No change in culture
3. Unity	Strong
4. Tradition	Strong
5. Dominance	Mother dominant
6. Motives	Intellectual
7. Evidence of hostility	None, except one brother
8. Conformity of well members	All but one brother who ran away

Medium family. Three manic depressives.

Family Eight has lived in Virginia since early Colonial times, and not far from the place where their ancestors settled. This is a large family composed of wonderful people, but if you see one you see them all. In other words, they look alike and behave in much the same manner. The pattern of behavior is fixed on the highest plane. They are gentle, considerate, intellectual, and above all, the best of sportsmen. The second child in the family of six siblings was different from approximately the age of five. She seems to have been able to fit comfortably into the family pattern. She became fat and her next younger sister soon outstripped her in popularity. She has had manic depressive reactions and has recently had a prefrontal lobotomy. Undoubtedly there is a strong need in this family for its members to conform. One son is continuously hypomanic. There are three others with manic depressive psychosis.

FAMILY EIGHT

1. Location	Same
2. Social status	No change in culture
3. Unity	Strong
4. Tradition	Strong
5. Dominance	Mother dominant
6. Motives	Social
7. Evidence of hostility	No definite evidence
8. Conformity of well members	All but one. Hypomanic but not hospitalized.

Large family. Three manic depressives.

Family Nine: This family moved and scattered but the powerful dominance of the extremely brilliant father followed them. This family's pride was based on their intelligence, their reasoning power and lack of emotional bias. Yet three of their members developed manic depressive psychosis. One daughter revolted, married young and has no evidence of the disease.

FAMILY NINE

1. Location	Moved but returned
2. Social status	No change in culture
3. Unity	Strong
4. Tradition	Father dominant
5. Dominance	Strong
6. Motives	Intellectual and social
7. Evidence of hostility	Latter not attained
8. Conformity of well members	Strong All but one who escaped by changing culture

Medium family. Three manic depressives.

Family Ten would be considered by Jurgen Ruesch to be the upper, upper class. Some of its members have been well known in the halls of our nation's capital. However, there was a mother determined to have social prominence for her beautiful daughter. She wrecked the life of this daughter, who became an alcoholic. The daughter had two sons. One of these developed manic depressive psychosis. The family pressure, as well as the family unity, was intense.

FAMILY TEN

1. Location	Moved
2. Social status	No change in culture
3. Unity	Broken
4. Tradition	Strong
5. Dominance	Severe mother dominance
6. Motives	Social
7. Evidence of hostility	Marked
8. Conformity of well members	All conformed. Alcohol in quantities.

Large family. One manic depressive.

Family Eleven has existed around a Virginia seaport for several generations. Its members have always been socially prominent. Here again a standard has been set, so it is vital for the members to maintain the standard. The family tradition was strong. The mother was the sustaining force that motivated the group and held the siblings as a unit.

FAMILY ELEVEN

1. Location	Same
2. Social status	Same
3. Unity	Strong
4. Tradition	Strong
5. Dominance	Mother dominant
6. Motives	Intellectual and social
7. Evidence of hostility	None
8. Conformity of well members	All conformed

Medium family. Two manic depressives.

Family Twelve is a family that at first glance seems to be an exception to the rule. The mother and father of the two boys and their sister died when they were young. They were raised by aunts and uncles, so seemed to have no focus of dominance. When inspection is carried deeper we find that there is a very strong Jewish tradition for success. The older brother is steady, firm and dominant. The younger brother and his still younger sister have tried hard to conform to his demands. They all live together. They have the same business and are now successful. The youngest brother and sister have attacks of manic depressive psychosis.

It is interesting to note that in New York State in 1947 when the percentages of total admissions were separated according to race or religion the percentage of Jewish patients with manic depressive psychosis was much higher than any other while the negro race was the lowest on the list.

SUMMARY OF CHARTS OF INDIVIDUAL FAMILIES

1. Location	Same	8	Changed	4		
2. Social status	Same	11	Changed	1		
3. Unity	Strong	11	Absent	1		
4. Tradition	Strong	12	Absent	0		
5. Dominance	Mother	7	Father	2	Mixed	3
6. Motives	Definite	12	Indefinite	0		
7. Evidence of hostility		8	No evidence	4		
8. Conformity All conformed except those who	1. Ran away 2. Got sick 3. Became alcoholic					

Our study of these families shows many common characteristics. Margaret Mead[8] states that the common characteristic of the American family is their orientation into the future as well as their constant movement and need for change. These families have been set for several generations. They are fixed by a central motive and are oriented to either the past or to the standards of the present.

A composite chart of the twelve families illustrates the above conclusions.

We did not find the presence of mixed dominance that Frieda Fromm-Reichmann described, nor did we find any evidence for stating that those who became ill felt guilty because of injury to the family code. However, there is some evidence of their being ostracized by the family which we expect to report at a later date.

In order to check our findings further we reviewed the records of patients with manic depressive psychosis entering the University Hospital during the last four years. Of this group there were seventy-five charts that had sufficient family data to permit estimation of traits. The results of these findings are given below.

Family pressure for conformity to a central motive, or motives, radiating from a focus of dominance, was in evidence. The static nature of these families was striking, as well as the strength of the central theme.

Summary and Conclusions

Studies of persons with manic depressive psychosis have shown that many of them have similar attitudes which make them hard to reach. They are surrounded by an impenetrable shell of superficiality which is supported by a "one track" mind. This has been thought by some to be due to family pressure. It was found that manic depressive psychosis occurs more frequently in the southern states than in other parts of the Union. A questionnaire showed that families containing those with manic depressive psychosis felt more pressure to conform to the attitude of the parents and had less freedom than those families without the disease. Twelve families with manic depressive members were studied in detail. They were found to have a tendency to remain in the same location, to maintain the same culture pattern, which had become traditional. There was evidence of a strong focus of dominance and an obvious family motive to which the members had to conform. The results were conformity, manic depressive psychosis, alcoholism or flight.

It is interesting also that there is very little evidence of ulcers or colitis in this group. However the presence of vascular disease in the form of coronary pathology and hypertension is quite common. Undoubtdely, while members of these families conform, the hostility engendered by the family pressure is suppressed at a great deal of sacrifice, especially on the part of their arteries.

It is possible to explain manic depressive psychosis in these cases as an equivalent to flight from family pressure, a flight either into guilt and depression or into aggression and mania.

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TRAITS STUDIED FROM 75 MANIC DEPRESSIVE HISTORIES

1. Location		Same	63	Changed	12		
2. Social status		Same	65	Changed	10		
3. Unity		Strong	47	Broken	18		
4. Dominance		Father	16	Mother	47	Mixed	12
5. Motives	Intellectual		8	Economic and religious			5
	Economic		11	Social and religious			3
	Moral and religious		14	Social and economic			4
	Power		6	Social and intellectual			5
	Social		7	Power and intellect			3
			55				20

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Fragments of A Hypnoanalysis

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There are two major aims involved in the presentation of this paper. From the point of view of therapy, focus will be centered on two areas of conflict in order to illustrate as clearly as possible examples of hypnotic technique and methods of approach utilized at times in hypnoanalysis by this writer. Such data will supplement other illustrations discussed elsewhere.[1-10] It is hoped that this will serve to enrich the accumulating investigations in psychoanalytically oriented hypnotherapy. Stress must be placed on the fact that the writer's current concern is not with demonstration of method which is "better than" this or the other treatment method or theoretical orientation. Intent is directed toward contributing to available techniques for assisting some types of patients in working out certain types of conflicts. What may serve best the needs of one person may not do the same for another.

In addition to the presentation of technique and areas of conflict as mentioned above, a review of some general problems covered in treatment will be outlined. This will contribute to current literature dealing with types of cases amenable to hypnoanalytic procedure and should illustrate some dynamic material accessible to hypnoanalytic coverage.

General Case Data

The patient, a 24 year old single woman, the older of two children, sought treatment primarily because of her concern about a reaction of nausea and extreme distaste when there happened to be any physical contact with her father or any anticipation of such contact in ordinary, everyday situations. She lived with him and a younger sister. Her mother had died when the patient was a child. In addition to the concern over her reaction as mentioned, she revealed that she felt nervous, "high strung," and was unable to make her own decisions even in regard to purchases of clothing for herself. She had doubts and fears as to what people thought of her. She felt unduly concerned about being accepted by everyone and this acceptance had to be demonstrated completely. For several weeks prior to treatment she suffered lapses in memory and found herself reading sentences, numbers, and letters of words in reverse. Such reversal appeared in her writing also. During the course of treatment she became aware of a "submerged feeling of having been in some way cheated."

Summarizing some of her insights and gains in a post-therapy communication, the patient wrote:

"Although I always felt outwardly that my parents gave me all the love a child requires, I now realize that during the various times that my mother was hospitalized before my sister was born, I did not have active proof of her love. My father, being preoccupied also did not show his affection for me. I felt as though I were not wanted. The feeling was made much more intense by the various aunts with whom I lived and their attitude of constant nagging and 'don't do this and don't go there.' When my sister was born I felt as though something more was being taken away from me and resented it thoroughly. During my mother's final illness I probably felt as though I either caused her death or hastened the process. This feeling was intensified by an ignorant family of aunts and a

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grandmother who was also very much hurt by her loss. The physical needs of a handicapped sister increased the amount of jealousy and resentment that I had toward her. With the realization of the fact that she had to have these attentions came a feeling of guilt on my part plus the guilt feelings surrounding my mother's illness and death.

"I had gone through many years with these things as a burden. Being afraid to speak up in school for fear of being wrong and thus being ridiculed or 'not being accepted and loved.' Not buying something for fear that it wouldn't be liked by others. Not making my own decisions because others mightn't approve of them. Added to all of this I met A——, identified him with my father and began to have even more guilt feelings.

"As these things became more and more clear to me my own personality began to change radically and dramatically. I no longer felt jumpy or nervous. I began to meet people on a freer plane. My decisions are mine—completely. My relationship with my father is back to a normal, happy one. As a matter of fact I am happier these past two months than I can ever remember being before. My doubts and fears are gone and those that have not completely gone are now on a level where they can be understood and dealt with. I still feel the need to be accepted but I do not expect not to feel that way. That would be going all the way to the other extreme. However, I now feel that this need for acceptance is a very normal thing on the part of every living person and I do not feel it to the point where it is a neurotic thing."

The portions extracted from this written communication from the patient at the close of treatment serve to outline some of the background data to the material presented below. These data representing her view of herself assist in conveying something about her personality.

The series of treatment contacts covered a period of a little more than four months with eighteen sessions of which six hours involved the use of hypnosis. Interviews were once a week except for a couple of missed appointments. Contact has been maintained with the patient who has continued to be well after a year.

Hypnosis Data

There had been considerable repression in the area of affective and ideational experience centering around her mother's death. That such material was pushing toward consciousness became evident during the early hypnosis work, although its full implications could not be recognized completely at the time. When the patient was being introduced to various hypnotic procedures, she was instructed regarding the visualizing of scenes. The latter were supposed to appear and the patient was then to describe them. After the first, another came to view. She revealed, "It was a hospital ward. I was standing by the door looking in. That's all."

At a later session, when free associating in hypnosis, the patient said:

"I feel as though there's something sitting on my head or my mind and won't let me think. It keeps intruding. I want to push it away and it (draws up her right hand as she is lying on the couch)—it's almost like a dream where something is there and you reach out and it disappears and as soon as you stop, it's there again. (Dr.: Do you know what it is?) No. (Dr.: You'll see it in a dream—a hypnotic dream. Tell it to me when it's over.) (Pause.) I saw a lot of big black trees—heavy ones—with a wall—part of a wall—a brick wall—a high one—part of the wall was blacked out—I saw someone trying to climb over it—got one foot on the top—that's all. (She described part of the wall as being dark in one spot as if it were broken through and part was missing.) The person climbing over should have been able to walk through . . ." (The patient was told that she would have the dream over again and this time the person would walk through the broken part of the wall instead of attempting to climb over. The patient would then reveal what the person sees.)

"There's a lot of ground. Clipped grass. And in a distance there's a big house with an iron fence around it. Miles and miles of ground. It reminds me of a cemetery but there are no stones. Don't like the cemetery. I never go there with my father. I haven't gone in years. I don't like to go. We always get lost there. I'm not afraid of it. I just don't like it. I cry when I go there—I don't know why I cry. Other people are there. It embarrasses me when they cry . . . they don't mean it . . . I don't like the rest of the family to cry on my shoulder and tell me how sorry they are for me. They don't mean it. (She revealed that at her mother's funeral they did not leave the car and did not permit the patient to do so either. She cried there but not later. She said she realized she wouldn't see her mother again. She was compelled to accompany relatives on visits to the cemetery when younger but for several years now she had not returned there.) I don't like to go with my father because I don't like the way he looks. I don't like the way he gets tears in his eyes and I think it embarrasses me too. I don't see why I should have to go to the cemetery to show I can remember things . . . She doesn't know the difference . . . They tell me I have no respect because I don't go. It isn't true. I have more respect and am more sincere than all the rest of them are. Why be a hypocrite about it . . . I don't like my house. I don't like my aunts. They're nasty. Hypocrites. They're not nice people. They'd slit each others throats for the fun of it I think. (Pause.) I see

the grounds again. I don't know why it reminds me of a cemetery. It doesn't look like one." (Dr.: "Do you want to see something in the cemetery?") "I don't think so (in a whisper)."

In view of the obvious emotional implications of this material the conjecture appeared warranted that the patient had been deeply troubled for some time by something related to it. In order to avoid influencing the nature of her productions and yet at the same time to assist in their expression, the patient was told that she would dream about something very important to her which had been troubling her for a long time. She appeared to grow anxious and looked as if she were about to cry.

"My mother is lying in bed in a hospital. I was standing by the doorway. I wanted to go over to her but I didn't because I was afraid to get caught. I wasn't supposed to. It was the last time I saw her. It makes me want to cry."—Dr.: "You may cry if you wish." (The patient's hand moved about over the couch.)—Dr.: "Anything else?"—"After that she died—about a week later. I don't know if she knew I was there or not. She was unconscious a good part of the time. Maybe if she were conscious it must have hurt her very much because I didn't go over." (At this point she was told that she would develop increasing insights about her father and mother with awareness of the insights occurring within her ability to tolerate them.) (Pause.) "Is it possible to be ashamed and guilty about something for so many years and not know it?"—Dr.: "About what?"—"About not going into that room. Not going when I was prodded. I'm ashamed of crying before other people."—Dr.: "I'm not 'other people.' "

The patient cancelled her next appointment owing to illness involving nausea, tenesmus, and diarrhea. By the time she returned again one week later she had spontaneously identified her distress as psychosomatic in nature relating it to the anxiety associated with the material of the previous hypnosis session and becoming aware of some of her own resistances in this regard. Before treatment was terminated, this data had become adequately assimilated. The aforementioned material was elaborated further.

Dealing with the aforementioned material achieved certain results and changes in the patient. She noticed, aside from an increased feeling of well being, that her reaction toward her father disappeared. She was no longer repelled by physical contact or anticipation of such contact. She felt a burden had been lifted from her. Also, the feeling of emotional involvement with her friend A—— disappeared and only the physical attraction to him remained. When mentioning all of this, she told of the change in feelings toward A—— immediately after speaking about the altered reaction to her father, but when it was called to her attention she could not account for it despite the apparent relatedness.

Then, during the session at which the above data appeared, hypnosis was induced and the patient was told that she would have a dream which would explain the relationship between her loss of emotional attachment to A—— and the clearing of her reaction to her father. She revealed:

"All I saw was A——'s room and some of his clothes on the floor and that was all. Nothing else happened. Nothing else came into the dream. It just faded." When asked to associate to this, she said, "My father leaves his clothes around. Never hangs them up and that annoys me. I always have to go picking up after him just like a baby." The original purpose of the dream was then restated to the patient.—Dr.: "Do you see the connection?"—"A—— is ordinarily very neat . . . he's a very neat person. My father isn't . . ."—Dr.: "Do you see what the dream is telling you?"—"The only thing I can think of is that I was subconsciously trying to substitute A—— for my father in some way."—Dr.: "Shall we investigate that further?"—"Yes."

The patient was told that she would visualize a hypnotic scene which would be indicative of A—— and her father being substituted for one another. Her resistance then appeared in typical fashion in such situations. (Pause.)

Dr.: "Have you seen the scene?" "I haven't seen anything at all but I feel as though I'm sinking."—Dr.: "Let yourself go all the way down. Deeper and deeper. You're going to see something. Tell me what it is."—"Walking on the boardwalk. Shortly after I met him (A——). It's in the evening, in the early part of the fall. We have other people with us. We had been at my friend's house earlier. We were playing cards. He was teasing me. Then we went for a ride in a car. Five of us. . . . We went to the boardwalk. We sat on a bench. He put his head in my lap. He kept teasing me all the time, saying things that annoyed me. He was talking in I——— (a foreign language). B—— and C—— and A—— were joking around. I knew A—— was teasing me."—Dr.: "How does it explain the substitution?"—"My father likes to tease me. When I was younger he and my mother used to talk in G——— (a foreign language). I couldn't understand what they were saying. It annoyed me. My father likes to tease me also."

At this point the patient was given post-hypnotic suggestions for attainment of gradual insight into the identification of A—— and her father and the reasons for her having been repelled by her father's physical proximity. Before the session could be terminated, however, the patient appeared about to say something and finally did.

"If I identified A—— with my father (pause) then my physical affair with him was like parental incest! (About one month prior to this session, the patient had, as a matter of fact, asked A—— to have intercourse with her. This would have been her first such experience with anyone. He declined, and the possible reasons for this were beyond our ability to explore at this time.) (Dr.: You see why you would be repelled?) Yes! I never saw any similarity between them!"

The patient appeared somewhat anxious and uncomfortable so direct reassuring suggestions were given and inquiry made regarding any desire for post-hypnotic recall of the data. She expressed a desire for such recall and the hypnosis was terminated.

Discussion

The material offered in this paper indicates certain types of situations which may be approached successfully with hynoanalytic techniques. The methods employed here are relatively few in number with major emphasis on the use of visual imagery. The large variety of hypnotic activities which can be brought into play have been discussed descriptively and by illustration in other papers. In this case no attempt was made to analyze the transference. The work appeared to be accomplished satisfactorily without this step. And the risk of prolonging a therapeutic venture which might be dealt with well enough otherwise seemed questionable in view of certain economic considerations. There is some question as to whether it could have been accomplished meaningfully in this time-limited situation. The evidence on hand pointed also to the likelihood that further work could and would be pursued at a later date if it appeared necessary. This patient's ego strength appeared to be fairly good, thus favoring the reasonably rapid response in treatment with acquisition of insight.

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26 WEST 9th STREET

An Electric Shock Casualty

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Boston, Massachusetts

As the number of electric shock treatments is increasing, it becomes obvious that under standard conditions, the EST is a safe method of treatment. The number of deaths reported is very small indeed in comparison with thousands and thousands of treatments given. Examination of the reports brings out the fact that in each fatal case the patient was suffering from severe hypertension, arteriosclerosis, cardiac disease, nephritis, or tuberculosis prior to electroshock therapy.[1,2,3,4,5,6,7] We report here another case of death of a patient who died of cerebellar hemorrhage after the seventh treatment.

CASE NO. 50789, B.S.H. The patient, a 51-year old male, was known to be suffering from a severe essential hypertension with multiple cerebro-vascular lesions. In 1946 he was put on rice diet because of high blood pressure, 220/160—240/180, but refused to adhere to it. In 1948 he was readmitted to the same hospital and later discharged with the diagnosis of hypertensive encephalopathy. In 1949 he was treated at the neurological service of another hospital and discharged with the diagnosis of hypertension with multiple cerebral lesions. He was admitted to Boston State Hospital July 18, 1950. A diagnosis of psychosis with hypertensive encephalopathy was made.

History. Patient's mother died at the age of 60 of a cardiovascular accident. The patient was the youngest of 13 children. The patient had always been an active, sociable, unstable, good-natured individual. In 1932, he had cystotomy in which a large stone was removed. Two years prior to his admission he had collapsed at work and remained at home since. He became irritable, grandiose, paranoid, confused and untidy; euphoric at times, greatly depressed at other times. Two months prior to admission he became extremely quiet, to the point of being stuporous at times, with an occasional outburst of aimless pacing back and forth and manneristic gestures. He stopped eating and lost weight rapidly.

Physical Examination. The patient was emaciated. Heart—slightly enlarged, no murmurs. EKG—borderline T2. Blood pressure 220/160. Lungs—clear. X-ray of the chest—prominence of the aortic nob. The heart appeared slightly enlarged and the left border rounded.

Neurological Examination. Pupils reacted to light and distance. Eye-grounds: fundi showed silver wire changes and v-a nicking, but no exudate or hemorrhages. There was normal prick sensation, mild left facial weakness of the corner of the mouth, normal hearing, thickened dysarthric speech, bilaterally increased deep tendon reflexes with bilateral extensor plantar responses, incontinence of urine, right hemiparesis, no Kernig. Tongue deviated to left. The patient was observed having one grand mal type of seizure. EEG—borderline.

Laboratory findings: Blood count within normal limits. Hct.—44. Hinton—negative. NPN—42 mg. per 100 cc. of blood. The circulation time—18 seconds, PSP excretion time of two hours—63%. Cerebro-spinal fluid: I.P.-160, F. P.-120, colorless, WBC—none. Pandy +, total protein—65 mg. per 100 cc., Gold Sol. 0012332100. Urine—albumin + 1, on one occasion, sugar—0, bile—0. Spec. gravity—1220.

Mental Examination showed at first much confusion, clouded sensorium, disorientation, incontinence, visual hallucinations, later a severe depression. He had to be tube-fed. He would not eat and had repeated crying spells. Usually mute, when pressed he expressed ideas of worthlessness.

Treatment: After repeated physical examinations, a series of electric shocks was commenced. The patient's depression was relieved after the first few treatments. He began to talk freely, became more friendly, his appetite improved. He was given six treatments without untoward reactions. The

From the Boston State Hospital, Pathological Laboratory.

seventh and last EST was given on September 1st, 1950, at 10 A.M. Immediately after it, the patient vomited a small amount of orange-colored material while still in the recovery room. He was unsteady on his feet and restless. When put to bed he was thrashing about, kept his eyes closed, did not respond when spoken to. The pupils were equal and regular, both eyes deviated to the left and slightly upward. There was no respiratory difficulty. He died at 1:20 P.M.

Pathology: An autopsy performed three hours later revealed that the cause of death was a right spontaneous cerebellar hemorrhage associated with hypertensive heart disease, coronary sclerosis and nephrosclerosis. The heart weighed 450 gms., valves were competent, the wall of the left ventricle thickened, right coronary ostium narrowed; left anterior descending and circumflex branches were calcified and narrowed, no scars in myocardium. Right kidney showed advanced nephrosclerosis with hydronephrosis. Brain weighed 1440 gms. Pia-arachnoid was congested and red and amount of sub-arachnoid was increased. The brain was edematous—the gyri flattened, the sulci—shallow. There were no gross changes on the surface of the cerebrum. The right cerebellar hemisphere was larger and softer than the left. It broke as the brain was lifted out of the skull, revealing a large intracerebellar hematoma. The weight of this hematoma which came easily out of its niche was 40 gms. The hemorrhage was due to rupture of the right superior cerebellar artery, destroying the nucleus dentatus brachium pontis anterior and medial cerebellar lobes and most of the lower lobe. Sections of the brain showed severe arteriosclerosis of all cerebral arteries and two old vascular lesions, a round deep cyst of softening in the head of the right caudate nucleus undermining the anterior limb of the right internal capsule and a narrow slit-like softening 2.2 cm. long in the left putamen. These lesions obviously antedated the electric shock treatments. Microscopical examination of the blocks of brain tissue taken from various areas revealed a number of changes, especially in the frontal, occipital and cerebellar lobes.

Pial vessels. Showed thickening of intima, splitting and thickening of the elastic membrane, narrow lumen, presence of cholesterol in widened spaces, calcification, and occasionally hyalinization of the vessel-wall. Many large and small pial vessels contained fresh thrombi. In the cortex, vessels appeared larger than usual with large walls and proliferation of endothelium. An occasional vessel with perivascular lymphotic infiltration was seen. Hyalinized vessels were frequently seen.

Nerve-cells of 3-4 layers showed degenerative changes. No active neuronophagia was noticed, but loss of cells was evident. Hemosiderin encrusting the vessels and in the macrophages was seen in the cortex. Small areas of lacy, wide-meshed appearance, perivascular dilatations without infiltration with strands of tissue bridging them over and very mild increase of astrocytes were also seen.

Adrenals. Most pronounced changes in the zona fasciculata—the normal pattern disturbed, the cells grouped in round formations containing from 3 to 12 cells. The cells could be recognized only by the presence of the nuclei, the cytoplasm appearing foamy, consisting of tiny bubles. In many places the cell membranes had burst and several cells formed one bubbled surface. Only a small number of dark cells of zona fasciculata appeared intact.

Pituitary gland. Showed evidence of increased activity of basophils and acidophils, especially basophils. They contained from one to three vacuoles in the cytoplasm, and small hyalinized areas resembling Crooke's changes were seen.

Microscopical diagnosis: Hypertensive encephalopathy, cerebral arteriosclerosis, adrenal and pituitary overactivity.

Discussion:

This patient, who at 51 had severe hypertension, hypertensive heart disease, general and cerebral arteriosclerosis, presented also a picture of severe depression which caused his commitment to the state hospital. Knowing the relief depressed patient receive from electric shock treatments it was decided to administer a series of electroshock treatments. The dangers involved were understood but the patient was in such great need

of mental treatment that the risk was considered worth taking. It was comparable to the danger of a surgical operation in a patient who is a poor surgical risk but may be expected to benefit from the operation.

The autopsy showed extensive damage caused by the hypertensive disease, widespread severe cerebral arteriosclerosis, vascular cerebral lesions, coronary sclerosis and nephosclerosis obviously preceding the shock treatments, and evidence of increased adrenal and pituitary activity following them. The cerebellar hemorrhage which followed the last (7th) treatment could conceivably have taken place even if the EST were not given, judging by the severity of the arteriosclerotic involvement. The remarkable point is that the patient with a very severe cardio-vascular disease and multiple cerebrovascular lesions withstood the stress of six electric shock treatments and was relieved of his depression. EST which at first glance appears to be the cause of the patient's death on further analysis seems to be less implicated. What may look like an EST casualty on closer scrutiny may be interpreted as another proof of its safety, except in extreme degree of vascular degeneration.

Conclusion:

A case of severe vascular degenerative disease with encephalopathy is presented in which death followed the seventh EST. It seems that the death of this patient who survived six electric shock treatments and died of apoplexy after the seventh could not be ascribed entirely to EST, the latter being a contributory factor only. This casualty emphasizes the difficulty of the decision the physician must make when a patient, who is in need of prompt mental treatment, is also suffering from a severe systemic disease.

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Neurological Traineeships Offered

The National Institute of Neurological Diseases and Blindness of the Public Health Service, in addition to awarding research grants and fellowships, now has funds available for traineeships in the field of rehabilitation.

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All inquiries should be addressed to Dr. Pearce Bailey, Director of the National Institute of Neurological Diseases and Blindness, National Institutes of Health, Bethesda, Maryland.

Neurological Clinical Pathological Conference

of the

Cincinnati General Hospital

CHARLES D. ARING, M.D., *Editor*

CASE NO. 249118

Presentation

A 46 year old colored male laborer was well until February 1949. In 1931 he had undergone an amputation of the right leg below the knee following an accident, but there was no other history of serious illness.

During the second week of February he developed pains in his knees. He continued to work at loading freight on trucks for another two days when pain developed in his left upper abdomen. This pain was incapacitating and he spent most of his time thereafter sitting in a chair at home. On March 9 he developed fever of 103° and a persistent non-productive cough. Fever was accompanied by severe generalized headache, throbbing in character, and aggravated severely by coughing. A coarse tremor of the hands appeared and he became bedfast because of malaise and weakness.

On admission to the hospital on March 12 he appeared in a good state of nutrition but was obviously acutely ill. He was oriented and cooperative. His skin was hot and dry. Temperature was 102°, pulse was regular at 110 per minute, respirations were 24, and blood pressure 122/78. The liver edge was palpable 1 cm. below the costal margin, the spleen was felt 3 cm. down. Neither organ was tender, both presented smooth surfaces. There was coarse tremor of both upper extremities which seemed worse on intention, and it was impossible for him to drink from a glass because of it.

On the following day he was confused at times. Many fine and medium rales were heard throughout both lungs. He continued delirious and restless with tachycardia and daily temperature elevations to 103°. On March 16 he lapsed into an unresponsive state with fixed and staring gaze, his neck became stiff, and there was bowel and bladder incontinence. This state persisted, and on March 17 his temperature rose to 106 degrees. Respirations became rapid and shallow. He expired March 18.

Laboratory studies were as follows: On March 12 the urine contained many coarsely granular casts. An examination of the peripheral blood on March 15 showed 3.14 million erythrocytes per cmm. and 9.8 grams of hemoglobin per hundred cc. The hematocrit was 29 per cent. The erythrocyte cellular indices showed a mean corpuscular volume of 92 cubic microns, mean corpuscular hemoglobin of 31 micromicrograms, and mean corpuscular hemoglobin concentration of 33 per cent. There were 136,000 leukocytes per cubic millimeter, and a differential count revealed the following percentages: polymorphonuclear neutrophiles 71 per cent, metamyelocytes 15.5 per cent, myelocytes C 4.5 per cent, myelocytes B 0.5 per cent, lymphocytes 4 per cent, monocytes 3 per cent, and basophiles 1.5 per cent. Examination of the sternal bone marrow showed hyperplasia of the granulocytic series (neutrophilic and eosinophilic) at the level of myelocytes C and above. The erythrocyte series of the sternal marrow was moderately depressed.

On March 16 a lumbar puncture showed an initial pressure of 280 mm. of water. Twenty-five cc. of yellow fluid were removed, and the final pressure was 120 mm. The fluid contained 395 leukocytes per cmm. of which 62 percent were lymphocytes and 38 per cent polymorphonuclear leukocytes. The cerebrospinal fluid sugar content was 47 mg., chlorides 654 mg., and protein 830 mg. per cent. Several acid-fast bacilli were seen in a stained smear of the cerebrospinal fluid sediment. The cerebrospinal fluid Wassermann was negative, the colloidal gold curve was 1255444333. The blood Kahn was negative. A roentgenogram of the chest on March 12 showed miliary densities scattered throughout the entire extent of both lung fields.

Treatment consisted of streptomycin, penicillin, and intravenous fluids.

Differential Diagnosis

*Dr. J. Park Biehl:** The patient we are considering today was apparently quite well until the onset of an acute illness which lasted for only a month before ending fatally. It was fairly insidious in its onset, with headache, fever, and tremor of the hands. Whatever diagnosis we consider at the time of admission, we should think also of meningitis or meningeal irritation, especially since meningitis is usually successfully treated with antibiotics and since the importance of diagnosis in the early stages cannot be overly stressed. Performance of lumbar puncture was delayed for 4 days, probably because the hematological disorder so occupied the minds of the house officers that meningitis either was obscured or forgotten.

On first glance the nature of the blood disorder appeared to be leukemic. For many

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reasons, among them the patient's age, the presence of only more mature elements in the blood, and the lack of platelet depression with only a moderate anemia, the leukemia, if it was leukemia, was the chronic myelogenous form. The platelet determination is not given in the protocol and is, therefore, assumed to be normal. The spleen was not severely enlarged. The patient was asymptomatic up to only two weeks before he came into the hospital. I would conclude, therefore, that the presence of leukemia could be of less significance than one might initially suppose, and that we must look further for an explanation of his acute illness. It is not an unusual experience, for example, to discover leukemia in the course of the general medical workup of a patient who originally presents himself with a totally unrelated condition. The latter may then be temporarily ignored, and its importance realized only when it has progressed to a more advanced, and perhaps untreatable, stage.

We see that subsequent to admission the patient progressed rapidly downhill. On the fourth day he was stuporous; it is stated that he had a staring gaze, his neck became stiff, and that he became incontinent. Lumbar puncture was done at that time. It is not mentioned whether he was worse or better after the tap was done. The results of the tap are of great significance for we now have definite proof of something else besides leukemia; acid fast bacilli were found in the cerebrospinal fluid. But it was too late for on the next day the patient expired.

It is strongly suggested that this patient had tuberculosis along with leukemia. But which of his signs could we attribute to leukemia? Leukemia of the nervous system is not a rarity yet we do not understand just why it affects the nervous system nor too much of its various manifestations. Ordinarily there is little to indicate a cerebrospinal fluid study in a patient with leukemia. Probably if more taps were done in these patients we would be surprised by the frequency of central nervous system involvement. According to one study (Schwab and Weiss), 20 per cent of all cases of leukemia will show neurological manifestations. The main signs are cranial nerve palsies, reflex changes, pyramidal tract signs, paresthesias, and meningeal irritation. Meningeal or intracranial hemorrhages may occur. Conceivably a greater number have, as I have suggested, meningeal involvement without symptoms. In a patient in this latter category one would find increased pressure and cells in the cerebrospinal fluid, the cells may be either leukemic or inflammatory cells. The protein would most likely be elevated and the chlorides would be normal. The sugar content might be somewhat depressed due to the presence of an excess of cells, but this is never particularly great. It would seem that our patient could have had his central nervous system signs because of leukemia which could produce an insidious, progressive, fatal, primarily neurologic disease. However, acid fast bacilli were found in the cerebrospinal fluid.

The single roentgen study of the chest revealed a diffuse nodular process throughout which is typical of miliary tuberculosis and at the same time consistent with a number of other conditions, including histoplasmosis, mitral stenosis, asthma, and certain pneumoconioses. None of the latter seem worth considering in this case. One might wonder if leukemia would produce infiltrate in the lungs such as this. It could, but it is usually lymphatic leukemia that acts in this fashion. It occurs in patients who have a much faster moving form or are nearer death from leukemia itself. So I would doubt that these roentgen findings represent leukemic infiltrate.

Miliary tuberculosis with meningitis is the likely consideration, and all of the patient's history and course could be explained on this basis. One might object to the short duration of his illness, for it appears that he was sick for only 9 days before he died, whereas the natural course of miliary tuberculosis is reckoned in weeks. I think it is here that the leukemia exerts its influence. Rich postulated that dissemination occurs in tuberculosis when bodily resistance is low. I suspect that in this case leukemia facilitated miliary spread and hastened death.

The cerebrospinal fluid was of special interest. Except for sugar content it was quite typical for tuberculous meningitis. While lymphocytes are usually predominant, we commonly see just as many leukocytes in

the earlier stages. The sugar of 47 mg. per cent represents only a mild depression and is not enough to be of diagnostic help. While the presence of round cells and a low sugar are the most valuable indicators in the cerebrospinal fluid that tuberculous infection is present, we have found that the sugar may be temporarily elevated to normal values or higher by the previous administration of parenteral fluids containing sugar. On one occasion we studied a patient in the following manner: the patient was tapped, and blood and cerebral fluid sugar determinations were obtained. Five per cent dextrose in water was then given intravenously over a period of three hours. Cerebrospinal fluid and blood sugars were then repeated. Originally the cerebrospinal fluid sugar had been less than 10 mg. per cent. Three hours later it was 110 mg. per cent. The blood sugars were both about the same before and after, 210 and 180 mg. per cent.

One final consideration is the possibility that the blood picture might represent a leukemoid reaction. This is a rare occurrence in miliary tuberculosis, yet miliary tuberculosis is about the most common producer of leukemoid reaction. The latter consists of an abnormal stimulation to put out large numbers of mature or immature myeloid or lymphatic cells suggesting leukemia. In the presence of miliary tuberculosis or of such diseases as pneumonia, carcinoma, and certain toxemias, the differentiation from a true leukemia may be impossible especially if the patient does not survive. Then we have to rely on the autopsy to make the differentiation.

The two types of leukemoid reaction seen in tuberculosis most commonly are a myeloblastic form and a lymphocytic form. In combing the literature for leukemoid reactions in tuberculosis I was able to find but one case resembling chronic myelogenous leukemia. Also, since the basophiles and eosinophils were elevated in neither bone marrow nor peripheral blood, leukemia might be favored slightly over a leukemoid reaction.

My final diagnosis is chronic myelogenous leukemia, miliary tuberculosis and tuberculous meningitis. In closing I would like to ask if the patient was tapped before or after the onset of stupor?

Dr. Charles D. Aring: He was tapped on March 16, four days after admission. He had been stuporous before, during, and after the lumbar puncture.

Dr. Biehl: I note that 25 cc. of cerebrospinal fluid were removed. One might postulate that a portion of his brain had herniated either transtentorially or through the foramen magnum producing pressure on the brain stem, which might have contributed to the patient's death.

Dr. Aring: The students all felt that the patient had tuberculous meningitis; one-third believed that this was accompanied by a leukemoid reaction, another third by myelogenous leukemia. One-third of the students didn't commit themselves further than tuberculous meningitis.

Discussion of Pathology

Dr. Murton Shaver: The autopsy was performed 7 hours after death. The brain weighed 1250 grams. The convolutional pattern was normal and there was slight widening of the sulci generally. The leptomeninges showed a general opalescence with increase in subarachnoid fluid and some cloudiness in the region of the Sylvian fissure bilaterally, more particularly on the right. The cortical veins were congested. A section of the pia-arachnoid was stripped from the right Sylvian region and floated on water, but this did not help to demonstrate tubercles although small localized whitish areas were noted in the membrane.

At the base of the brain the leptomeninges showed brownish discoloration generally and were thickened and fibrous in the interpeduncular fossa; also, there was some thickening over the inferior surfaces of the frontal and temporal lobes. There was no hippocampal herniation or Kernohan's notch. The cerebellum showed an unusual prominence of tonsils which may have represented an early stage of cerebellar pressure cone. The vessels at the base were normal in distribution as far as they could be seen.

The cerebrum, brain stem, and cerebellum were sectioned; these sections failed to reveal any shifting of the midline structures. The lateral ventricles were regular in size

and shape with normal ependymal lining. The third and fourth ventricles appeared normal in size and there was no roughening of the ependymal surface. Perivascular punctate hemorrhages or areas of congestion were scattered in the region of the basal ganglia and periventricular region and in the pons and medulla.

Microscopic studies of sections of the cerebral cortex showed the meninges to be extremely thick and infiltrated by scattered red blood cells and leukocytes; some of the latter were immature, polymorphonuclear cells. The meningeal vessels were severely congested. In patchy areas there was exudate in the meninges. Some of the meningeal vessels were thrombosed. There was focal loss of nerve cells equally and diffusely scattered throughout the cortex. The vessels of the cortex and white matter were congested and they were packed with leukocytes, some of them extended into surrounding nervous tissue. There was subpial gliosis and in some areas perivascular rarefaction in the cortex. There was occasional perivascular rarefaction in the white matter.

Section through basal ganglia showed the same nerve call change already noted in the cortex. In a few cases the vessel walls were markedly thickened, apparently due to proliferation of endothelial cells. The vessel walls showed necrosis in some areas and were infiltrated by leukemic cells.

Sections through pons showed meninges that were more markedly thickened than in the cortex. The vessels were distended and very severely congested; a few of the larger ones were thrombosed. There was some slight leukemic infiltration around these vessels. The nerve cells seemed to be swollen generally and there was some patchy loss of nerve cells and chromatolysis with some satellitosis.

Sections of the medulla showed changes in the meninges similar but still more marked than in the pons. Numerous perivascular hemorrhages and areas of leukocytic infiltration were present near the floor of the fourth ventricle and in the adjacent nuclei. The nerve cells showed extreme degrees of swelling and chromatolysis, many of them being lost. The spinal cord was not obtained at autopsy.

A thorough study of tissues other than nervous revealed chronic myeloid leukemia, hematogenous tuberculosis involving lungs, liver, spleen, tuberculous peritonitis and pyogenic septicemia with abscesses in the lung, spleen, and soft tissues of the buttocks.

Clinical Diagnosis

Miliary tuberculosis and tuberculous meningitis.

Chronic myelocytic leukemia.

Dr. Biehl's Diagnosis

Miliary tuberculosis and tuberculous meningitis.

Chronic myelocytic leukemia.

Anatomical Diagnosis

Chronic myeloid leukemia with infiltration of the brain and leptomeninges.

Hematogenous tuberculosis (which did not involve the central nervous system).

Pyogenic septicemia.

Dr. Aring: We have then no explanation for the several acidfast bacilli that had been seen in the stained smear of the cerebrospinal fluid sediment. Recalling my own youthful experience in long and tedious searches for the usually elusive bacillus of tuberculosis, I would not be surprised if a house officer would occasionally begin "seeing things" in these smears. I am reminded of Adelbert Ames' wise observation that "The things we see are the mind's best bet as to what is out front." Be that as it may, I suppose Dr. Biehl and other clinicians who saw the patient were forced to the diagnosis that they made partly by the report about the finding of a few tubercle bacilli. However, it is worth recalling that the cerebrospinal sugar content should be reduced in tuberculous meningitis, although, of course, there occurs the rare instance where this is not the case.

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